DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] Especially this invention relates to the liquid crystal equipment with which the part as which the flicker and the scan line were chosen is not conspicuous about a liquid crystal display.
[0002]
[Description of the Prior Art] Conventionally, a scan electrode group and a signal-electrode group are constituted in the shape of a matrix, inter-electrode [the] is filled up with a liquid crystal compound, many pixels are formed, and the liquid crystal display component which performs presenting of an image or information is known well. As a method of driving this display device, selection impression of the address signal is carried out periodically one by one, and the time-sharing actuation which a predetermined information signal is synchronized with an address signal, and carries out selection impression in juxtaposition is adopted as the scan electrode group by the signal-electrode group.
[0003] That these practical use was presented most For example, "applied FIJIKUSU Letters" () ["Applied] Physics Letters"1971 year, 18 (4) M. shut cited in 127-128 pages of numbers (M. "voltage DIPENDANTO- which becomes Schadt and W. HERUFURIHI (W. Helfrich) collaboration optical - activity OBU A Twisted Nematic liquid crystal" ()) ["Voltage] Dependent Optical Activity of a Twisted Nematic Liquid It was TN (Twisted Nematic) mold liquid crystal shown in Crystal."
[0004] In recent years, the activity of the liquid crystal device which has bistability nature as an improvement mold of an ordinary liquid crystal device is proposed by Clerks (Clark) and both of Lagerwall (Lagerwall) on JP,56-107216,A, U.S. Pat. No. 4367924 descriptions, etc. As bistability nature liquid crystal, the ferroelectric liquid crystal which generally has a chiral smectic C phase (SmC*) or H phase (SmH*) is used, and it sets in these condition. When the impressed electric field are answered, and either of the 1st optical stable state and the 2nd optical stable state is taken and electric field are not impressed, it has the property, i.e., bistability nature, to maintain the condition, and the response to change of electric field is in Sumiya. The large utilization in the field of the display of a high speed and a memory type etc. is expected.
[0005]
[Problem(s) to be Solved by the Invention] However, its number of the scanning lines (line) will increase as the liquid crystal device mentioned above becomes a big screen, and frame frequency (the number of scan screens per unit time amount) will fall. If frame frequency falls, the "******" (it is described as "striped flow" below) phenomenon a flicker (flicker) and the contrast difference of a line and a non-choosing line which made scan selection accompany a scan, and flows and is in sight will appear.
[0006] Moreover, when striped flow was conspicuous or a screen was divided and scanned as it jumped and impressed and the number of 1 screen (it is described as "frame" below) scan jump lines increased in the vertical scanning of multiple times in order to stop a flicker, the contrast difference arose with the scanned block and other blocks, it has been sensed by an observer's eyes as display nonuniformity, and display grace was spoiled remarkably.
[0007] Especially the ferroelectric liquid crystal component mentioned above had the remarkable flicker problem at the time of multiplexing actuation. The alternating voltage which made the phase of a scan selection signal the opposite phase for every write-in frame is impressed to the Europe disclosure No. 149899 official report, and the multiplexing driving method for performing black (a cross Nicol's prism being arranged so that it may be in a dark condition) selection writing with the frame which performs white (a cross Nicol's prism is arranged so that it may be in ******) selection writing, and continues with a certain frame is indicated. Moreover, the driving method indicated by the U.S. Pat. No. 4548476 official report, the U.S. Pat. No. 4655561 official report, etc. other than the above-mentioned driving method is learned.
[0008] Although the pixel of the white by which selection writing was carried out with the front frame at the time of the selection writing of the black after white selection writing serves as half-selection and this driving method is smaller than a write-in electrical potential difference, an effectual electrical potential difference will be impressed. Therefore, in the selection pixel of the white by which the half-selection electrical potential difference was uniformly impressed to every 1 / 2 frame periods (inverse number of 1 screen scan period which is an one-frame scan time), and the half-selection electrical potential difference was impressed to the white selection pixel which serves as a background of a black alphabetic character in the time of black selection writing by this multiplexing driving method, that optical property will change every 2 frame periods. For this reason, in the case of the display which writes a black alphabetic character in a white ground, as compared with the pixel as which the number of the pixels which chose white chose black, overwhelmingly, a white background will flicker, and it

will be visible. Moreover, in the case of a white character display, generating of a flicker is similarly regarded as the display which writes a black alphabetic character in an above-mentioned white ground by reverse at black figures. Usually, since an above-mentioned half-selection electrical potential difference is impressed by 15Hz which is 1 / 2 frame frequency when frame frequency is set to 30Hz, it will be sensed by the observer as a flicker and display grace will be spoiled remarkably.
[0009] Especially, in the actuation at the time of low temperature, for example compared with scan actuation of 15Hz frame frequency at the time of an elevated temperature, the ferroelectric liquid crystal needed to lengthen the driving pulse (scan selection period), and needed to consider it as scan actuation of low frame frequency which is 5-10Hz for this reason. For this reason, in the actuation at the time of low temperature, the flicker and striped flow which result from scan actuation of low frame frequency had occurred.
[0010] It is in enabling it to perform high-definition image display, without producing striped flow and display nonuniformity, also when an INTARESU scan and a screen are divided and scanned in order that the object of this invention may prevent a flicker and a striped flow phenomenon in the liquid crystal display of a big screen in view of the problem of such a conventional technique and another object of this invention may stop a flicker.
[0011]
[Means for Solving the Problem and its Function] The liquid crystal device which has the matrix electrode with which this invention consists of a scan electrode and an information electrode, And are liquid crystal equipment which has the 1st driving means which impresses a scan selection signal to the above-mentioned scan electrode, and the 2nd driving means which impresses an information signal to the above-mentioned information electrode at a list synchronizing with this scan selection signal, and it sets to the 1st driving means of the above. By adopting a specific scan method, the flicker and striped flow phenomenon which result from scan actuation of low frame frequency are prevented, and if [in high-definition image display] also in the liquid crystal display of a big screen, it closes.
[0012] Namely, the 1st of this invention is a driving means to which the 1st driving means of the above carries out sequential impression of the scan selection signal at a scan electrode, and carries out 1 frame scanning by one vertical scanning within 1 vertical-scanning period. The liquid crystal equipment reversed to hard flow by the time amount of arbitration is offered, and as the concrete mode, m frame scanning, after carrying out, a scanning direction is made into reverse, n frame scanning is performed, and a scanning direction repeats this (2 m, n= 1, 3 -- integer).
[0013] Furthermore, as for the 2nd of this invention, the 1st driving means of the above carries out jump impression of the scan selection signal within 1 vertical-scanning period at a scan electrode. It is what offers the liquid crystal equipment at least 1 time of whose direction of a vertical scanning it is the driving means which performs 1 screen scan by the vertical scanning of multiple times, and is hard flow during 1 frame scanning. The vertical scanning of the scanning direction is preferably carried out and carried out to reverse n times after a m times vertical scanning, and this is repeated (2 m, n= 1, 3 -- integer).
[0014] Moreover, the 1st driving means of the above carries out N division (3 N= 2, 4 -- integer) of the one screen, and the 3rd of this invention is a driving means which it scans 1 block at a time, and offers liquid crystal equipment with the 1-block scanning direction reverse [the scanning direction of other blocks] in at least one frame.
[0015] In the 3rd above-mentioned invention, it is desirable to make a scanning direction into reverse, to scan n blocks after a m block scan, and to repeat this (2 m, n= 1, 3 -- integer). Furthermore, sequential scanning or interlaced scanning is mentioned within a block as a scan method of each block.
[0016] The example [this invention] using a ferroelectric liquid crystal (it is described as "FLC" below) is given and explained.
[0017] Drawing 1 shows one example (drawing 2 is the X-X' sectional view of drawing 1) of the liquid crystal equipment of this invention, it is constituted so that the upside electrode group 11 (information electrode group A) and the bottom electrode group 12 (scan electrode group B) may serve as a matrix mutually, it is formed in glass substrates 13 and 14, respectively, and has the structure where the FLC ingredient 15 was inserted among them. Moreover, the scan electrode group B is B0, B1, and B-2 like a graphic display. They are -- and the field E, i.e., for example, scan electrode B-2, where the information electrode group consisted of A (A1, A2, A3 --), and one pixel was surrounded by the dotted line of drawing. Information electrode A2 It consists of fields E which overlap. It has connected with a power supply section (not shown) through a switch (SW), respectively, and each scan electrode group B and the information electrode group A have also connected said SW to the controller circuit (not shown) which controls the ON/OFF.
[0018] The polarizers 16a and 16b shown in drawing 2 make the polarization shaft cross, and are arranged, and the crossing polarization shaft is [the polarizers] good to be set up so that a dark condition may be formed with the elimination phase in the example of actuation which lower-**.
[0019] Drawing 9 is the block diagram showing the example of liquid crystal equipment of this invention. 901 is a display panel and the orientation of a ferroelectric liquid crystal is controlled by the electric field by the electrical potential difference impressed to an electrode on the intersection of the matrix which consists of a scan electrode 902, a signal electrode 903, and a ferroelectric liquid crystal with which it fills up between them, and consists of a scan electrode 902 and a signal electrode 903.
[0020] 904 is a signal-electrode actuation circuit. The image data stored in the line memory 912 which stores the parallel image data from the image data shift register 915 and the image data shift register 915 which store the serial image data from the information signal line 906, and the line memory 912 are followed. The signal-electrode driver 913 for impressing an

electrical potential difference to a signal electrode 903, the electrical potential difference VD further impressed to a signal electrode 903, O, and -VD It has the information side power-source switcher 914 changed with the signal from the change control line 911.

[0021] 905 is the scan electrode driver 917 for being a scan electrode actuation circuit and impressing an electrical potential difference to the scan electrode 902 in response to the signal from the decoder 916 for directing one scan electrode in all scan electrodes in response to the signal from the scan address-data line 907, and a decoder 916, the electrical potential differences VS and O further impressed to the scan electrode 902, and -VS. It has the scan side power-source switcher 918 changed with the signal from the change control line 911.

[0022] 908 is CPU and controls a transfer of a signal to control and the information signal line 906 of an image memory 910, the scan address-data line 907, and the change control line 911 in response to the clock pulse of an oscillator 909.

[0023] Drawing 10 draws the example of a ferroelectric liquid crystal cel typically. 101a and 101b are In 2O3 and SnO2. SmC* which carried out orientation so that transparent electrodes, such as ITO (indium-Tin-oxide), might be the substrates (glass plate) by which the coat was carried out and the liquid crystal molecular layer 102 might become vertical to a glass side between them The liquid crystal of a phase is enclosed. The line 103 shown by the thick wire expresses the liquid crystal molecule, and this liquid crystal molecule 103 has the dipole moment 104 in the direction which intersected perpendicularly with that molecule. If the electrical potential difference beyond a fixed threshold is impressed to inter-electrode [on substrate 101a and 101b], the helical structure of the liquid crystal molecule 103 can come loose, and the dipole moment 104 can change the direction of orientation of the liquid crystal molecule 103 so that all may be turned to in the direction of electric field. If the liquid crystal molecule 103 has the long and slender configuration, and the direction of a major axis and direction of a minor axis show a refractive-index anisotropy, therefore the polarizer of for example, a glass side each other arranged to the physical relationship of a cross Nicol's prism up and down is placed, becoming the liquid crystal optical modulation element which changes an optical property with an electrical-potential-difference impression polarity will be understood easily. When thickness of a liquid crystal cell is furthermore made thin enough (for example, 1micro), also in the condition of not impressing electric field as shown in drawing 11 , the helical structure of a liquid crystal molecule comes loose, and takes one of dipole-moment upward (104a) or downward (104b) conditions. if predetermined time grant of the electric field Ea from which the polarity beyond a fixed threshold differs, or the Eb is carried out as shown in such a cel at drawing 11 -- the dipole moment -- electric field Ea or the electric field vector of Eb -- receiving -- upward 104a or downward 104b, and the sense -- changing -- it -- responding -- a liquid crystal molecule -- 1st stable state 103a -- or orientation is carried out to either of the 2nd stable state 103b.

[0024] There are two advantages of using such a ferroelectric liquid crystal as an optical modulation element. It is that 1st a speed of response is very quick and that the orientation of a liquid crystal molecule has a bistability condition in the 2nd. If drawing 11 explains the 2nd point, and electric field Ea are impressed, orientation of the liquid crystal molecule will be carried out to 1st stable state 103a, but even if this condition cuts electric field, it is stable. Moreover, if the electric field Eb of the reverse sense are impressed, orientation of the liquid crystal molecule will be carried out to 2nd stable state 103b, the sense of that molecule will be changed, but even if it cuts electric field too, ruble is in this condition. Moreover, unless the electric field Ea to give exceed a fixed threshold, it is too maintained by each orientation condition. In order to realize effectively the speed and bistability nature of such a speed of response, the thinner possible one as a cel is desirable, and, especially generally 1micro-0.5micro - 20micro 5micro are suitable.

[0025]

[Example]

Example 1 drawing 3 is the actuation wave used by this example, and the ******** scan selection signal, the scan non-selection signal, the white information signal, and the black information signal are clarified. If a white information signal is impressed to the pixel on the scan electrode with which the scan selection signal was impressed from an information electrode The pixel is a phase T1. Phase t3 which is eliminated by the condition of dark (black) (the electrical potential difference of V3+V2 is impressed with V2 and a phase t2 with a phase t1, and it eliminates in the black condition), and continues Electrical-potential-difference-V3-V1 It is impressed and is written in the condition of ** (white). On the other hand, if a black information signal is impressed to the pixel on the same scan electrode from an information electrode The pixel is a phase T1. Phase t3 which is eliminated by the black condition (the electrical potential difference of -V3+V2 is impressed with V2 and a phase t2 with a phase t1, and it eliminates in the black condition), and continues Electrical-potential-difference V3-V1 It is impressed, the condition of front black is held and it is written in a black condition.

[0026] Drawing 5 is the voltage waveform impressed to a ferroelectric liquid crystal pixel, and the example of an actuation wave which produces the display condition shown in drawing 8 is shown. - in drawing 8 shows a write-in black condition, and O shows the write-in white condition.

[0027] First, driver voltage and pulse width are adjusted and frame frequency is made to be set to 30Hz. The result of having observed the generating situation of the flicker at the time of making every sequential scanning at this time and n frame (integer of n= 1 and 2 --) reversing a scanning direction with the naked eye is shown in a table 1.

[0028]

[A table 1]

フレーム周波数30Hzの時のフリッカー発生状況

反転周期	フリッカーの見え方
0（順次走査）	若干見える
1フレーム毎（図4）	見えない
2 〃	見えない
3 〃	見えない
4 〃	見えない
5 〃	見えない
10 〃	見える
15 〃	目だつ

In the example mentioned above, a flicker can be controlled by switching a scanning direction for every n (1<=n<=5) frame. Moreover, the value of this optimal n changes also with frame frequency, and can use not only these 1<=n<=5 but 6, 7, and the scan selection method switched every 8--n frames.

[0029] Especially, by this invention, also when the timing of a change of a scanning direction carries out by every frame and the time amount which does not synchronize with frame frequency, a flicker can be controlled.

[0030] Next, lowering pulse width is lengthened for driver voltage, and frame frequency is made to be set to 20Hz. The result of having observed the generating situation of the flicker at the time of making every sequential scanning and n frame (integer of n= 1 and 2 --) reversing a scanning direction at this time with the naked eye is shown in a table 2. The same effectiveness as a table 1 was checked.

[0031]

[A table 2]

フレーム周波数30Hzの時のフリッカー発生状況

反転周期	フリッカーの見え方
0	見える
1	見えない
2	見えない
3	見えない
4	見えない
5	若干見える
10	見える

It is thought that the flicker has been generated since the optical responses of liquid crystal differ in the time of a selection electrical potential difference being impressed and the time of un-choosing. Therefore, since a selection electrical potential difference is impressed to the same scan line with frame frequency in sequential scanning, the whole screen surface will carry out a flicker with frame frequency. According to this invention, in order to prevent the whole screen surface carrying out a flicker on the same frequency and to raise a flicker frequency simultaneously by switching a scanning direction, it is thought that the flicker has been hard that it comes to be visible.

[0032] Lowering and pulse width are further lengthened for driver voltage, and frame frequency is made to become the secondary example with 10Hz. The result to which" "also observed the that phenomenon (it is called striped flow below) which the line and the non-choosing line which made scan selection with the flicker when performing a jump selection method in every N book (integer of N= 1 and 2 --) at this time can be seen as a contrast difference, and this accompanies a scan and is [flow and] in sight with the naked eye is shown in a table 3.

[0033]

[A table 3]

飛び越し走査を行っただけの場合

飛び越し本数	フリッカーの見え方	縞流れの見え方
0	見える	見えない
1	見える	見えない
2	若干見える	若干見える
3	見えない	見える
4	見えない	見える
5	見えない	見える
10	見えない	見える
15	見えない	見える

As mentioned above, it can be improved by the flicker by carrying out interlaced scanning, but since striped flow is conversely conspicuous, display grace cannot be made good. Then, the result of having reversed the scanning direction for every field and having conducted the same experiment is shown in a table 4.
[0034]
[A table 4]
飛び越し走査でかつ走査方向を１フィールド毎に反転した場合

飛び越し本数	フリッカーの見え方	縞流れの見え方
1 (図6)	見えない	見えない
2	見えない	見えない
3	見えない	見えない
4	見えない	見えない
5	見えない	見えない
10	見えない	見えない
15	見えない	見えない

In the example mentioned above, a flicker and striped flow can be controlled by reversing a scanning direction for every field in interlaced scanning. Moreover, the applied period to reverse can use not only the 1 field but the scan selection method switched for every n (n= 1, 2 -- integer) field.
[0035] Especially, by this invention, also when the timing of a change of a scanning direction carries out by every field and the time amount which does not synchronize with field frequency, a flicker and striped flow can be controlled.
[0036] It is thought that are at the time of selection electrical-potential-difference impression and not choosing, the optical responses of liquid crystal differ, the contrast difference arose in the scan line chosen when interlaced scanning was carried out, and the scan line over which it jumped, and striped flow has produced line flow in order that this may carry out sequential migration of the screen top.
[0037] not seting always constant time amount until the line which prevented scanning the whole screen in the same direction, and was simultaneously chosen once in it by switching a scanning direction is chosen again according to this invention -- " -- that -- generating of "is prevented and it is thought that striped flow has been hard that it comes to be visible.
[0038] N division (3 N= 2, 4 -- integer) of the one screen was carried out for example 3 frame frequency to the scanning direction with 10Hz, after scanning divided 1 block several times, it performed scanning the following block several times, and it displayed on the full screen by repeating this. The result of having observed the display nonuniformity (it being called block nonuniformity below) the flicker, the striped flow, the scan selection block, and the non-choosing block at this time are in sight as a contrast difference with the naked eye is shown in a table 5.
[0039]
[A table 5]

分割走査を行っただけの場合

ブロック分割数	フリッカーの見え方	縞流れの見え方	ブロックムラの見え方
なし	見える	見えない	見えない
2	見える	見えない	若干見える
3	若干見える	若干見える	見える
4	見えない	見える	見える
5	見えない	見える	見える
10	見えない	見える	見える

Although it can be improved by the flicker by performing a division scan as mentioned above, since striped flow and block nonuniformity are conspicuous conversely, display grace cannot be made good.
[0040] Then, the result of having reversed the scanning direction for every block and having conducted the same experiment is shown in a table 6.
[0041]
[A table 6]
分割走査を行いかつ走査方向を１ブロック毎に反転した場合

ブロック分割数	フリッカーの見え方	縞流れの見え方	ブロックムラの見え方
2	見える	見えない	見えない
3（図7）	若干見える	見えない	見えない
4	見えない	見えない	見えない
5	見えない	見えない	見えない
10	見えない	見えない	見える

In the example mentioned above, a flicker and striped flow, and block nonuniformity can be controlled by reversing a scanning direction for every block in a division scan. Moreover, this period to reverse can use not only every block but the scan selection method switched for every n (integer of n= 1 and 2 --) block.
[0042] Also when it carries out to the timing to which the change timing of a scanning direction does not especially synchronize with every block and the scan number of a block by this invention, a flicker and striped flow, and block nonuniformity can be controlled.
[0043]
[Effect of the Invention] When it applies to the liquid crystal display with which an one-frame scan time becomes long (for example, low frame frequency which is 2-30Hz) according to this invention, the flicker and striped flow phenomenon based on a low frame frequency scan can be controlled.

[Translation done.]

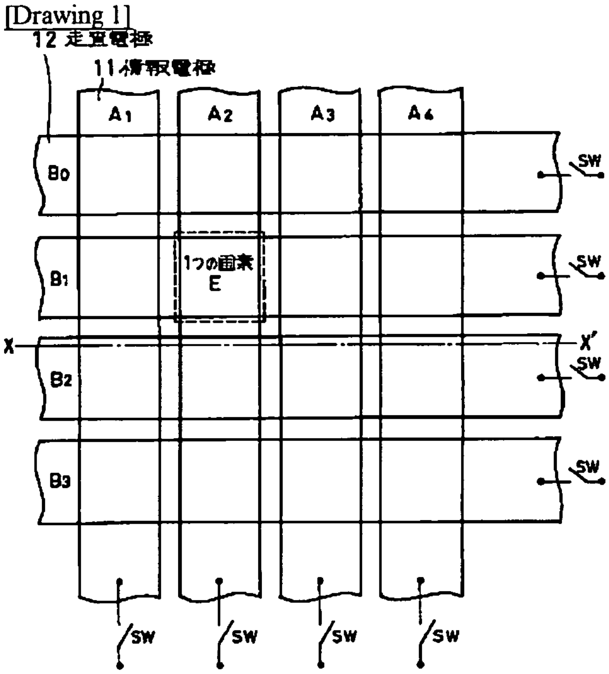
* NOTICES *

Japan Patent Office is not responsible for any damages caused by the use of this translation.

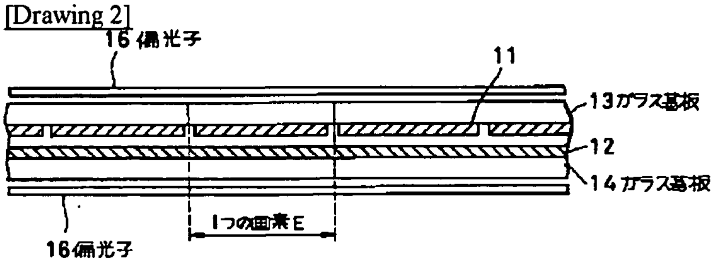
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

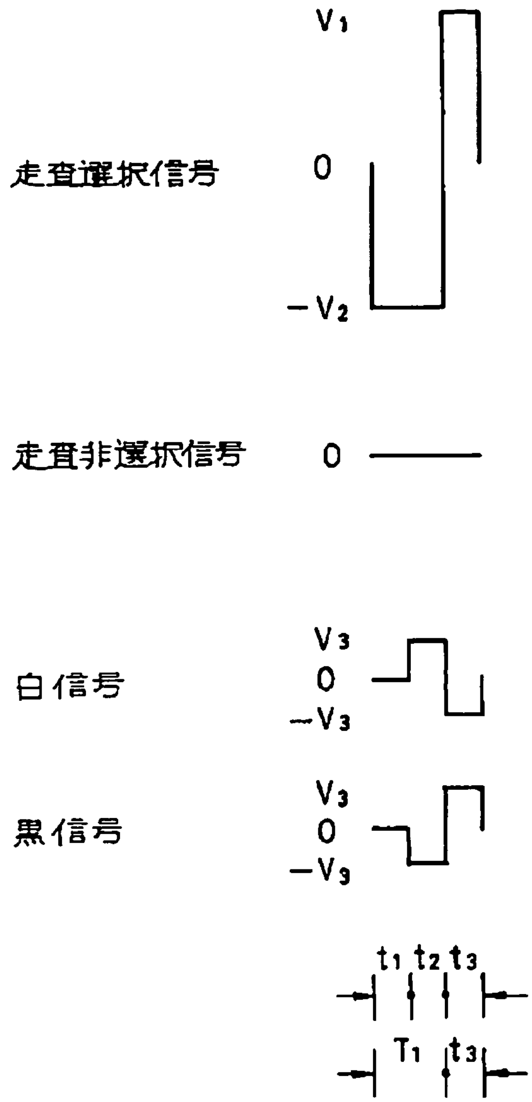
[Drawing 1]



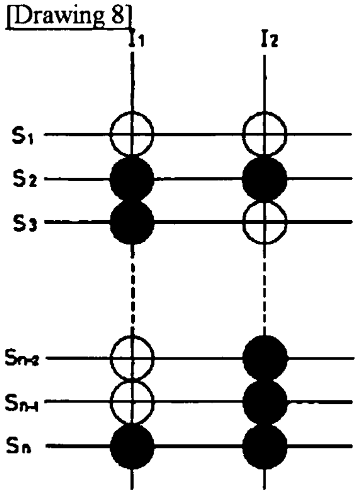
[Drawing 2]



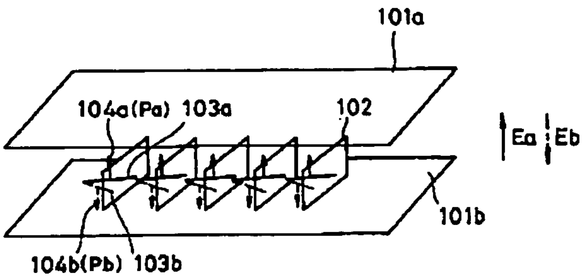
[Drawing 3]



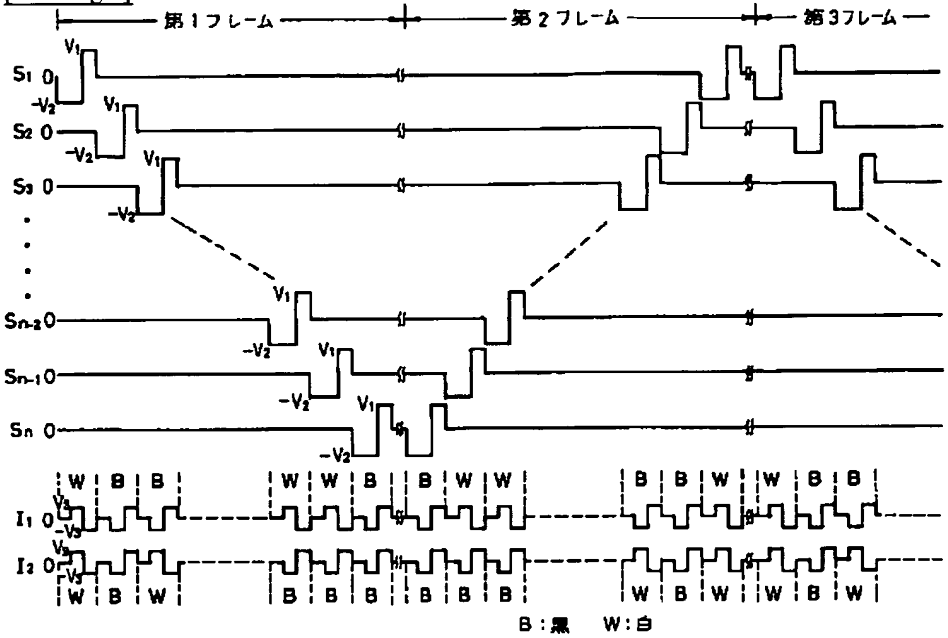
[Drawing 8]



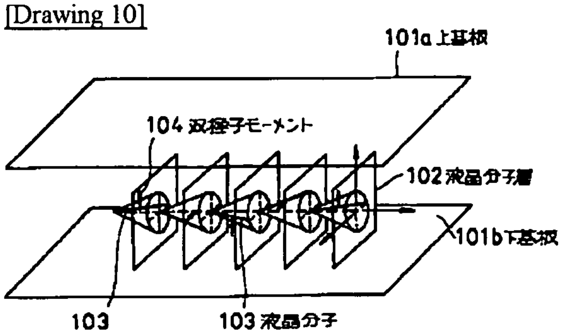
[Drawing 11]



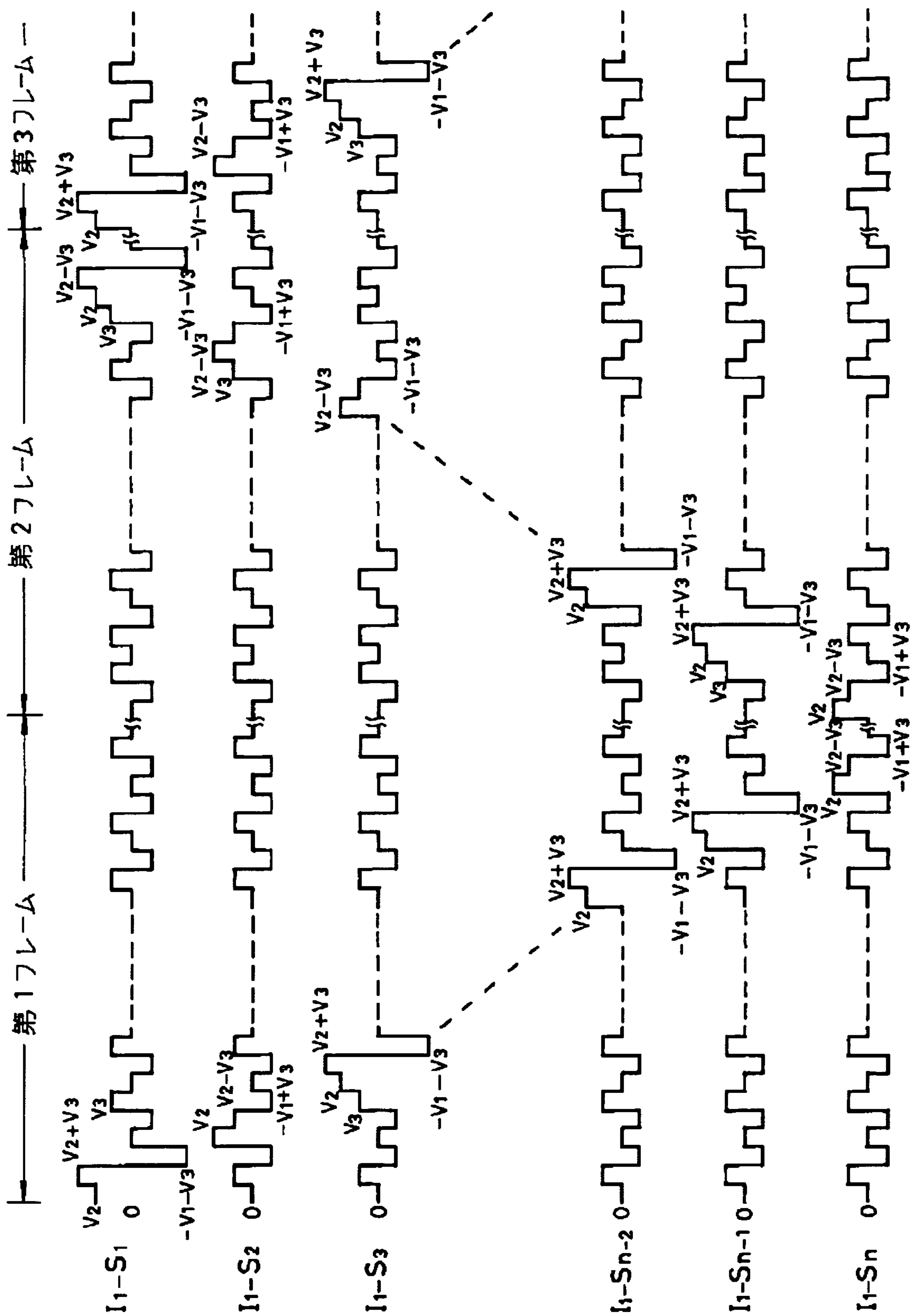
[Drawing 4]



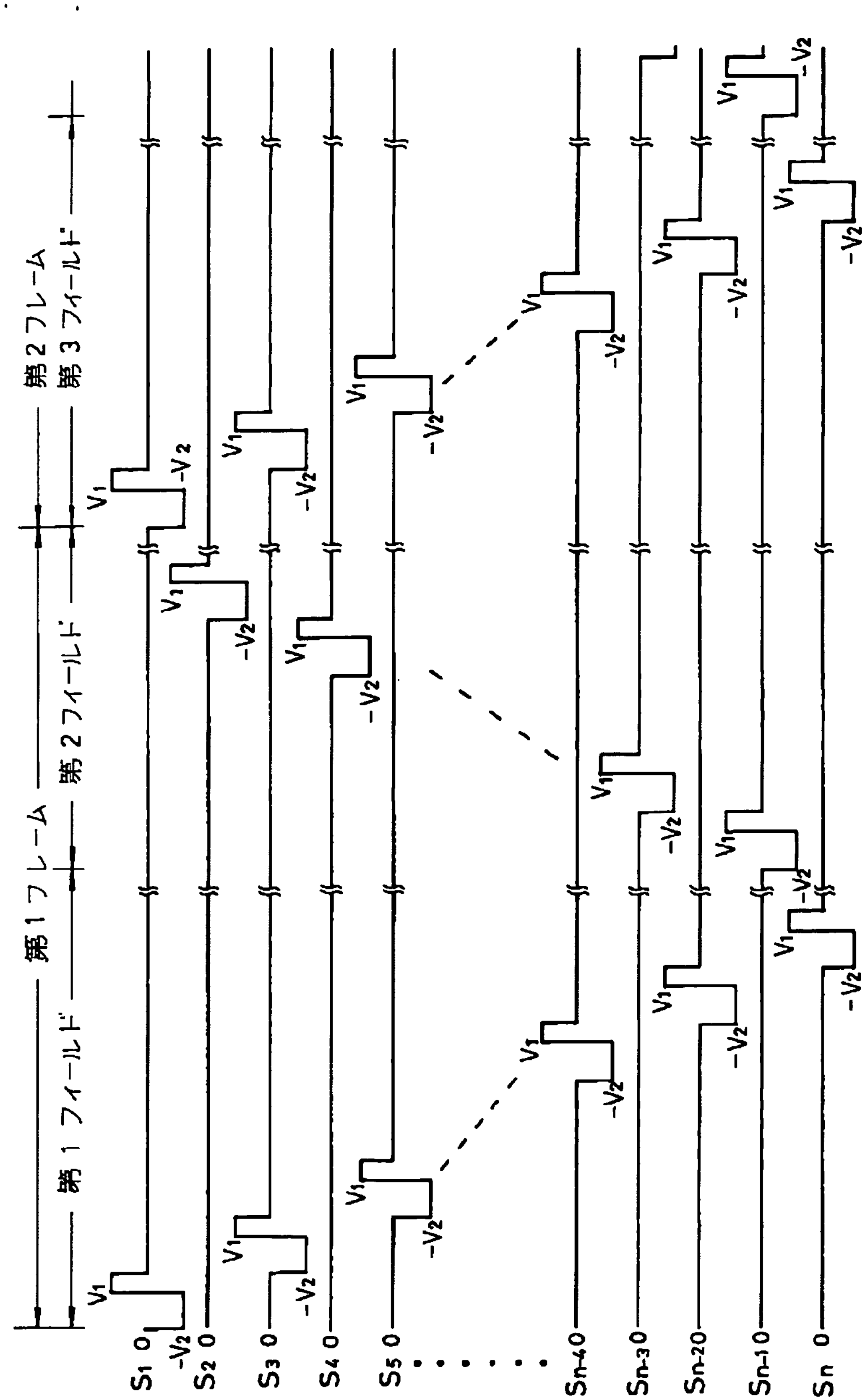
[Drawing 10]



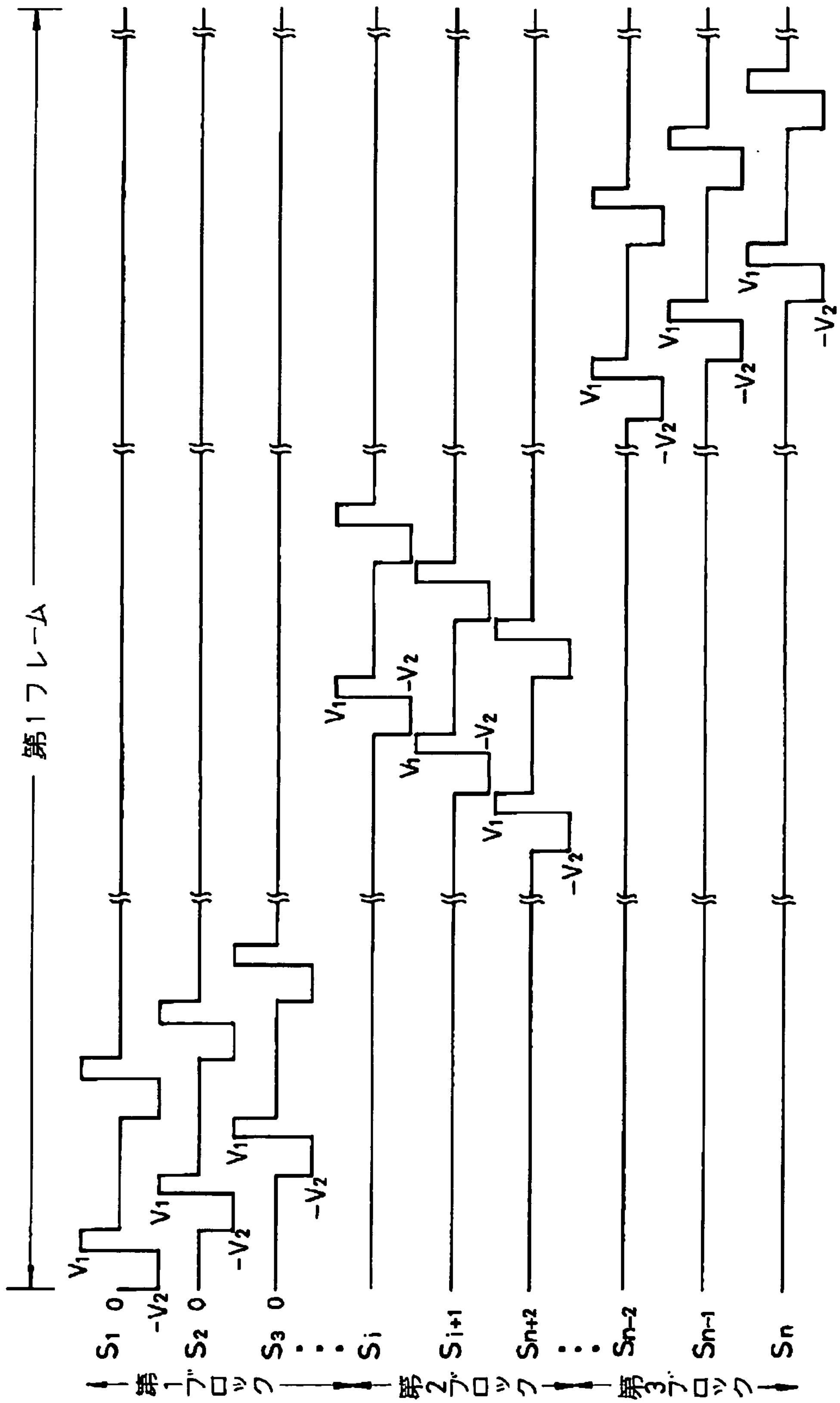
[Drawing 5]


第1フレーム
第2フレーム
第3フレーム
I1-S1
I1-S2
I1-S3
I1-Sn-2
I1-Sn-1
I1-Sn
V2+V3
V2-V3
-V1-V3
-V1+V3

[Drawing 6]


第1フレーム
第2フレーム
第1フィールド
第2フィールド
第3フィールド
S1
S2
S3
S4
S5
Sn-4
Sn-3
Sn-2
Sn-1
Sn
V1
-V2
0

[Drawing 7]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第1ブロック
第2ブロック
第3ブロック
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S2
S3
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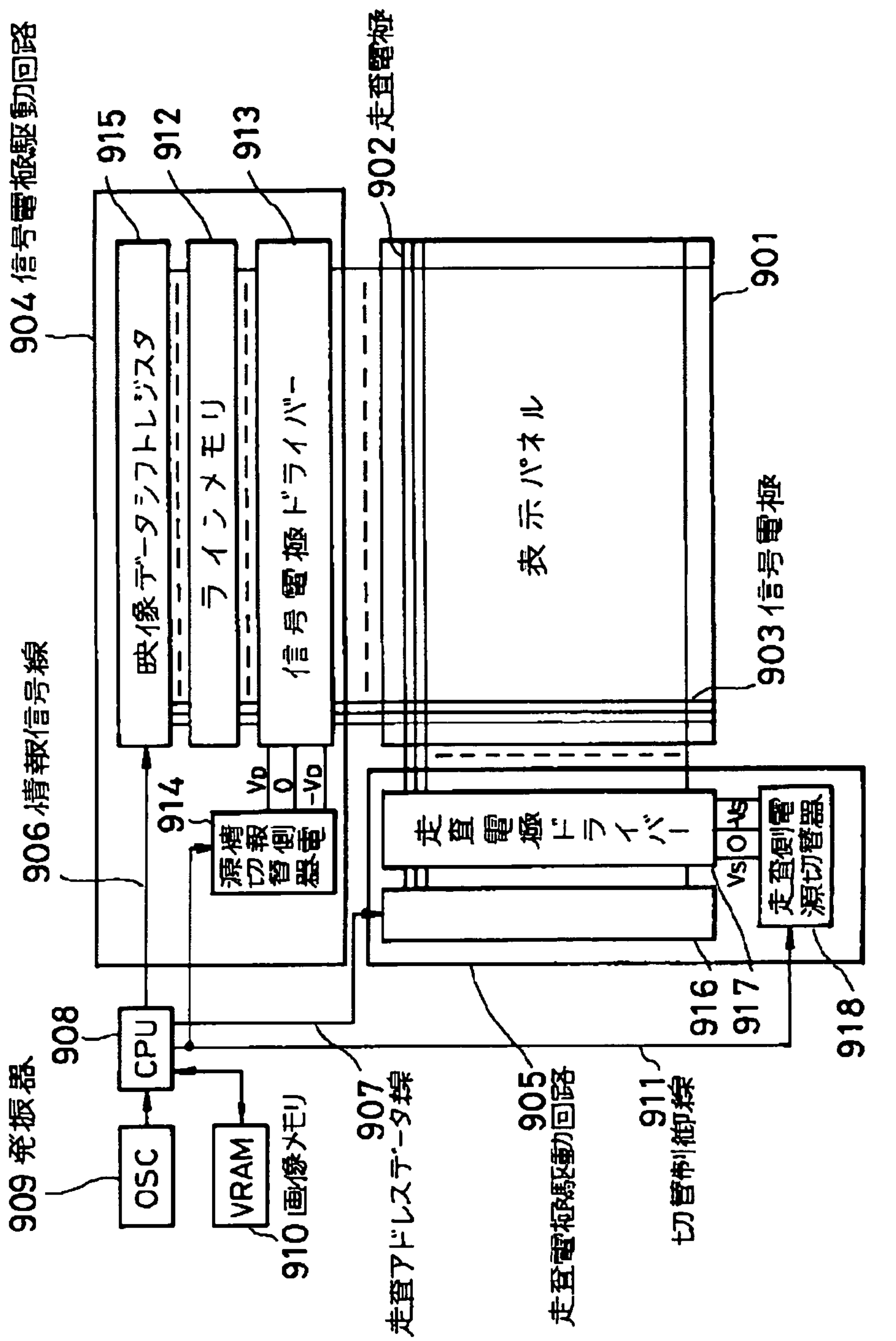
Si+1
Sn+2
Sn-2
Sn-1
Sn
0
V1
-V2

[Drawing 9]



[Translation done.]